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DIAGNOSIS AND TREATMENT OF ASTHMA IN PAEDIATRICS

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INTRODUCTION

Asthma is one of the serious allergic diseases and the most common chronic childhood disease in developed country.[1] It has been characterized by increased responsiveness of the tracheobronchial tree to a multiplicity of stimuli[2-4], increased infiltration of various inflammatory cells especially eosinophils into the airway, epithelial damage, airway smoothmuscle hypertrophy[5], constriction, variable airway obstruction usually associated with inflammation in the conducting airways of the lungs[6] and mucous hypersecretion in the bronchiolar walls of the lung.[7] The word 'asthma' is derived from the Greek meaning ' panting' or 'labored breathing'. Asthma is chronic inflammatory of airways in which many cells and cellular elements play a role, in particular, mast cells, eosinophils, T lymphocytes, macrophages, neutrophils and epithelial cells. Asthma is critically dependent on a series of cell adhesion molecule- mediated interactions between vascular endothelium and leukocytes[8], leading to symptoms[9] and elevation in total serum IgE.[10] It is manifested physiologically by widespread narrowing of the air passages and clinically by paroxysms of dyspnoea, cough, wheezing and tightness, provoked by one or more triggers such as physical exertion and airway irritants (cold, dry air, smoke, etc.).[4-10] It is an episodic disease, with acute exacerbations interspersed with symptom-free periods. Typically, most attacks are short-lived, lasting minutes to hours, and clinically the patient seems to recover completely after an attack. However, there can be a phase in which the patients experience some degree of airway obstruction daily. This phase can be mild, with or without superimposed severe episodes, or can be much more serious, with severe obstruction persisting for days or weeks; the latter condition is known as “acute severe asthma”. In unusual circumstances, acute episodes can cause death . Asthma exacerbations are characteristically worse at night and can progress to severe airflow obstruction, shortness of breath, and respiratory distress and insufficiency. Rarely, severe sequel such as hypoxic seizures, respiratory failure, and death can occur.[10] In the development world has recently focuses on asthma because of its rapidly increasing prevalence, affecting up to one in four urban children. Over 300 million people around the world suffer from this non communicable respiratory disease. Recent report shows wide variation (4-19%) in the prevalence of asthma in schoolgoing children from different geographical areas in India.[11] Susceptibility to asthma can be explained in part by genetic factors, developmental, and environmental factors, which interact to produce the overall condition. Asthma is the disease of the respiratory system in which the airways constrict, become inflamed, and are lined with excessive amounts of mucus, often in response to one or more “triggers,” such as exposure to an environmental stimulate (or allergen), cold air, exercise, or emotional stress. In children, the most common triggers are vital illnesses such as those that cause the common cold. Asthma is a chronic condition in which these airways undergo changes when stimulated by allergens or other environmental triggers. Such changes appear to be two specific responses.[12,13,14,15,16]

Pathophysiology

The major characteristics of asthma include a variable degree of airflow obstruction (related to bronchospasm, edema, and hyper secretion), BHR, and airways inflammation. Evidence of inflammation arose from the studies of nonspecific BHR, bronchoalveolar lavage (BAL), bronchial biopsies, and induced sputum, as well as from postmortem observations of patients with asthma who died from an attack of asthma or from other causes. To understand the pathogenesis mechanism that underlie the many variants of asthma, it is critical to identify factors that airways and to determine how these immunologic and biologic processes produce the characteristic airways abnormalities. Immune responses mediated by IgE antibodies are of foremost importance. Asthma is particularly complex in children because several elements of the immune system including antigen presentation, T-cell function and antibody production are immature and thus facilitate atopic responses.[17] Inter-actions between the rate of immune system maturation and lung growth and development during the first years of life seem to be crucial in the development of asthma . In addition, the airways of infants and children are more susceptible to obstruction due to their smaller size and

the soft ribcage offers poor support for the underlying lung, which recoils to volumes more likely to cause airway closure . All of these phenomena are influenced by the childs genes[18] and by the interaction between genetic, developmental and environmental factors.[19]

Type of asthma

An acute asthma attack is caused by inflammation in the airways of the lungs, causing contraction and narrowing of the airways (bronchioles), restricting airflow and making breathing very difficult. where as Chronic asthma is a lung condition characterized by frequent asthma attacks and requiring medical management to prevent and minimized acute attacks. Exercise-induced asthma (EIA) is a limited form of asthma in which exercise triggers coughing, wheezing, or shortness of breath. This condition generally occurs in children and young adults, most often during intense exercise in cold dry air.

Symptoms are generally most intense for 10 minutes after exercise and then gradually subside.

EIA is triggered only by exercise and is distinct from ordinary allergic asthma in that it does not produce a long duration of airways activity, as allergic asthma does.

Cause of asthma

The most common things in the environment that triggers asthma leads to asthmatic are exercise allergens, irritants, and viral infections.

Allergens like Animal dander (from the skin, hair, or feathers of animals), Dust mites (contained in house dust), Cockroaches, Pollen from trees and grass and Mold (indoor and outdoor).

Irritants like Cigarette smoke, Air pollution, Cold air or changes in weather, Strong odors from painting or cooking, Scented products, Strong emotional expression (including crying or laughing hard) and stress.

Others like Medicines such as aspirin and beta-blockers, Sulfites in food (dried fruit) or beverages (wine), A condition called gastro esophageal reflux disease that causes heartburn and can worsen asthma symptoms, especially at night, Irritants or allergens that you may be exposed to at your work, such as special chemicals or dusts and Infections.

Symptoms

Wheezing: When breathing out is nearly always present during an attack. Usually the attack begins with wheezing and rapid breathing, and as it becomes more severe, all breathing muscles become visibly active.

Shortness of breath (dyspnea): Shortness of breath is a major source of distress in asthma patients, although severe dyspnea does not always reflect a serious attack or reduced lung function.'

Coughing: In some people the first symptom of asthma is a nonproductive cough Chest tightness (pain): Initial chest tightness without any other symptoms may be an early indicator of a serious attack. The neck muscles may tighten, and talking may become difficult or impossible. Chest pain occurs in about three- quarters of patients; it can be very severe, although its intensity is not necessarily related to the severity of the asthma attack itself.'

Rapid heart rate and sweating The end of an attack is often marked by a cough that produces thick, stringy mucus. After an initial acute attack, inflammation persists for days to weeks, often without symptoms.

Diagnosis

In most cases, a physician can diagnose asthma on the basis of typical findings in a patient's clinical history and examination. Asthma is strongly suspected if a patient suffers from eczema or other allergic condition-suggesting a general atopic constitution-or has a family history of asthma. While measurement of airway function is possible for adults, most new cases are diagnosed in children who are unable to perform such tests. Diagnosis in children is based on a careful compilation and analysis of the patient's medical history and subsequent improvement with an inhaled bronchodilator medication. In adult, diagnosis can be made with a peak flow meter (which tests airway restriction), looking at both the diurnal variation and any reversibility following inhaled bronchodilator medication. There are no specific diagnostic tools or surrogate markers for detecting asthma in infancy. Therefore, asthma should be suspected in any infant with recurrent wheezing and cough episodes. Frequently, diagnosis is possible only through long-term follow-up, consideration of the extensive differential diagnoses and by observing the childs response to bronchodilator and/or anti-inflammatory treatment. Testing peak flow at rest (or baseline) and after exercise can be helpful, especially in young asthmatics that may experience only exercise-induced asthma. If the diagnosis is in doubt, a more formal lung function test may be conducted. Once a diagnosis of asthma is made, a patient can use peak flow meter testing to monitor the severity of the disease.[12,13,14,15,16]

Pharmacotherapy

The goal of pharmacotherapy is control of symptoms and prevention of exacerbations with a minimum of drug-related side-effects. Treatment should be given in a stepwise approach according to the persistence, severity, and/or frequency of symptoms and should take into account the presenting asthma phenotype. It should be noted that some children will not respond to specific therapies. Children starting a new therapy should be monitored and changes made where appropriate.

Medications currently available for childhood asthma include

Reliever medications
• Short-acting inhaled b2 agonists
• Other bronchodilators
Controller medications
• ICS (inhaled corticosteroids)
• LTRA
• Long-acting b2 receptor agonists (LABAs) (only in combination with ICS)
• Sustained-release theophylline
• Anti-IgE antibodies
• Cromolyn sodium
• Oral steroids

Reliever medications
Short-acting b2 agonists
• Treatment of choice for intermittent and acute asthma episodes in children, very young children and for preventing exercise-induced asthma. (The presence of exercise induced bronchospasm is, however, an indication to start regular preventive treatment with ICS or an LTRA).
• The safety margin for dose range is wide and determination of the optimal dose can be difficult.
The lowest effective dose that provides adequate clinical control and minimizes side-effects, such as tachycardia, dizziness and jitteriness, is recommended.
• Salbutamol, the most commonly used drug, has a favorable safety and efficacy profile in patients aged 2–5 years.[20]
• Terbutaline and formoterol also have safety and efficacy profiles comparable to that of salbutamol; directions for use are similar.

Ipratropium bromide
• The only other reliever of any relevance. In acute asthma its combined use with b2 agonists may result in favorable outcomes in children[21], although results were ambiguous in those less than 2 years of age.[22]
• Side-effects are few and current evidence supports trial use when b2 agonists alone are not fully effective.

Regular controller therapy. The main goal of regular controller therapy should be to reduce bronchial inflammation.

ICS
• A first-line treatment for persistent asthma.
• Reduces the frequency and severity of exacerbations.
• Should be introduced as initial maintenance treatment (200 lg BDP equivalent) when the patient has inadequate asthma control.
• Atopy and poor lung function predict a favorable response to ICS (23).
• If control is inadequate on a low dose after 1–2 months, reasons for poor control should be iden- tified. If indicated, an increased ICS dose or additional therapy with LTRAs or LABAs should be considered.
• It has been known for many years that the effect of ICS in older children begins to disappear as soon as treatment is discontinued. [24]
• New evidence does not support a disease-modifying role after cessation of treatment with ICS in pre- school children.[25,26.27]

LTRA
• An alternative first-line treatment for persistent asthma.
• Evidence supports use of oral montelukast as an initial controller therapy for mild asthma in children[28], as it provides bronchoprotection[29], and reduces airway inflammation as measured by nitric oxide levels in some preschool children with allergic asthma.[30,31]
• Younger age (<10 years) and high levels of urinary leukotrienes predict a favorable response to LTRA (32).
• A therapy for patients who cannot or will not use ICS.
• Useful also as add-on therapy to ICS as their mechanisms of action are different and complementary.[33]
• Suggested as treatment for viral-induced wheeze and to reduce the frequency of exacerbations in young children aged 2–5 years.[34,35]
• Benefit has been shown in children as young as 6 months of age.[36,37]

LABA
• Add-on controller therapy to ICS for partially con-trolled or uncontrolled asthma.
• Efficacy is not well documented in children in contrast to adults, and use should be evaluated carefully.[38,39]
• Safety concerns have been raised recently[40], suggesting that use should be restricted to addon therapy to ICS when indicated.
• Combination products of LABA and ICS may be licensed for use in children over 4–5 years, however, the effect of LABAs or combination products has not yet been adequately studied in young children under 4 years.

Oral theophylline
• There is anecdotal evidence that low-dose theophylline may be of benefit in select groups of children who remain uncontrolled on ICS, LTRAs or LABAs.
• Theophylline is inexpensive, and in some countries, it is used for children whose families cannot afford ICS, LTRAs, or LABAs.
• Due to its narrow therapeutic index and variable metabolism rates between patients, blood levels must be monitored closely.

Cromolyn sodium (nedocromil)
• Cromolyn sodium can be prescribed for children as young as 2 years of age.
• Efficacy is in question,[41] however, and it is less effective than ICS.
• Must be used frequently (four times per day), and may take up to 4 weeks to work.[42]
• Free of side-effects.
• Available as oral or nasal inhalers, nebulizer solution, and eye drops.

Anti-IgE antibodies

• Patients aged ‡12 years may benefit if they have moderate-to-severe persistent atopic asthma that is inadequately controlled despite treatment with other therapies.[43]

• Mode of application and cost will limit this intervention to patients who fail to respond to currently available therapies.

• The therapeutic index (benefit-to-risk ratio) of this relatively new agent is still being defined.

Risks and side-effects of pharmacotherapy. Awareness of potential side-effects of pharmacotherapy is mandatory. Precautions and considerations for each agent are listed below.

Short-acting b2 agonists: These agents are generally safe when used intermittently and earlier concerns about deaths when used for all age groups on a regular base have not been substantiated.[44] However, the potential risk of tremor and hypokalemia must be taken into account.

CONCLUSION

Asthma is a chronic lung disease which has no permanent cure. Alternative medicines are the preventive therapy which has minimal side effects, used in long term medication. But emergency treatment needs allopathic medicine, which gives quick relief. So survival of asthmatic patients is impossible without using allopathic medicine. The need of the hour is to develop an allopathic system using the principles of alternative approaches to diminish the side effects for treating asthma. Patients with recurrent nasal polyps or intolerance reactions to NSAIDs should not hesitate to undergo provocation tests. Avoiding the substances in isolation does not improve their asthma. Adaptive deactivation can have a favorable outcome for nasal and asthmatic symptoms. To improve asthma, leukotriene receptor antagonists are available.

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